

X.—*Observations on the species of Termitidæ of West Africa, described by Smeathman as Termes bellicosus, and by Linnæus as T. fatalis.* By T. S. SAVAGE\*.

HAVING read a condensed account and many extracts from the communication of Dr. Smeathman to the Royal Society of London on the insect in question, it seemed to me that no room was left for the discovery of additional facts. But, residing in the locality of the Termes, I felt a desire to know personally their œconomy; first, from motives of interest in the general subject of natural history; and secondly, in order to discover some way of preventing their supposed attacks on our buildings.

As I proceeded, I noticed some mistakes made by Dr. Smeathman or his many copiers, which induced me to record my own observations. Of these the following is a summary.

I would here remark, that I have never seen the original nor entire publication of Dr. Smeathman's paper; but what I have seen, is sufficient to show that he was an acute observer, a man of indomitable perseverance and accurate to a remarkable degree. The best account that I have read of his paper is that of Edward Newman, Esq., F.R.S., in his 'Familiar Introduction to the History of Insects.' It is free from the marks of a prurient imagination, and indicates more of a desire to relate the simple truth in the history of the insect than any that I have seen. The figures, however, which stand at the head of his account are decidedly bad.

The first thing that strikes a visitor who is familiar with Adamson's and Smeathman's observations, when he arrives on the coast of Africa, is the great sparseness of the Termites' hills. Instead of "acres so thickly covered as to appear like the huts of native settlements," his eye may wander over acres *without seeing one*; one cause of this sparseness may have arisen to some extent from the introduction of civilization. The visitor usually lands first at the European or American settlements, where the hills in their immediate vicinity are mostly destroyed. This has been done, first, from the notion that the insect "ate down their dwellings;" and, secondly, from the superiority of the clay of which they are constructed, which is used for building purposes. At no point, however, between Cape Verd and the Gaboon river, will the stranger remark them for their numbers.

They more frequently occur on plane and flat lands; making their appearance especially soon after the lands have been cleared for planting, at which time trees are left girdled and prostrate to decay.

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The features which first strike the beholder are their great size and form. These have been well represented by Smeathman, though two hills cannot be found exactly like. Their contour is generally that of a hay-stack—the surface never regular, always marked with protuberances and upward projections, often not unlike “turrets,” as termed by Smeathman.

Sometimes the hill presents the aspect of a mound having been worn down by the heavy rains, or, if in the vicinity of a village, by children playing upon it. In such cases they may be forsaken.

When they present distinct upward projections or turrets, they are known to be in the process of enlargement. This is always the mode in which these insects increase their domiciles. Turrets are projected one after another, and the intervening spaces filled out, so as to make a continuous surface. Within each of these turrets is a cavity which leads down as a passage into the interior of the hill, or terminates in some other passage, keeping up a free communication throughout the structure. When hills present in their general outline the form of a hay-stack, they have arrived at their maximum size. Their height in such cases is from 12 to 15 feet perpendicular measurement, the circumference at base from 50 to 60 feet; at two-thirds the height, or around the base of the “dome,” from 30 to 40 feet.

The materials have for their base clay, generally strongly tinged with oxide of iron in the recent state; after exposure to the sun and atmosphere it takes on a light colour, approaching a dull yellow, in some cases white. There is an admixture, more or less, of other substances incidentally occurring, as gravel, leaves, straw, &c.

Sometimes the clay presents a dark, slaty aspect, which is incorrectly stated in books to be an indication of a different species of insect. This fact is owing to different-coloured clays existing in different localities.

The strength of these structures is incalculably great; as an evidence of this, Smeathman states that they are often mounted by wild bulls, and four men were known to stand on one to spy a vessel at sea. But more than this, *they would sustain more wild bulls and men than could possibly mount them.* The particles of clay are cemented together by a fluid excreted from the mouth of the insect (not as Smeathman says, by gums elaborated from the different kinds of wood on which they feed). This, by exposure to the sun and atmosphere, becomes exceedingly hard and tenacious on the surface, added to which, the action of the well-known principle in mechanical philosophy involved in the arched form of the structure gives to it a vast degree of strength. This feature in the œconomy of the *Termes fatalis*—the strength of

the domiciles—is a wise provision in nature. It guards the hills against the heavy wasting rains of the country, and enables them to resist the shock of decayed falling trees, which so often occur on recently cleared grounds. When it is known that it is the practice of the natives of Africa not to plant the same piece of ground two years in succession, but let it lie fallow four or five years, and clear up a new spot every year, and as many trees are girdled and left to decay and fall, the wisdom of this feature will be understood.

On clearing away the shrubbery and grass around the base of a hill, several covered ways or clay tubes will be seen leading to neighbouring stumps and decayed logs. These tubes, sometimes 12 inches in diameter at base, gradually diminish, ramifying as they proceed outward. If their connection with the hill be broken, as many holes will be seen, constituting mouths of passages, which run in a sloping direction to a depth of 12 or 18 inches under the domicile. These passages expand into basement rooms, bounded by clay pillars, supporting a series of archwork on which rest the “cellular work,” “royal apartments,” and superincumbent interior portions of the structure.

The exterior of the hill consists of a clay wall varying in thickness on the different sides from 6 inches to  $1\frac{1}{2}$  foot. Throughout this wall there are cavities, cells and passages, anastomosing and running from the base to the apex, forming a communication with the “dome.” Within, at the base, elevated to a height of *one to two feet above the surface of the ground*, and central in respect to the circumference of the hill, is the apartment of the king and queen, styled by Smeathman “the royal chamber,” surrounded by many other apartments or chambers, containing eggs and young of various sizes and stages of growth, all supported by the archwork mentioned.

It will be observed, that Mr. Smeathman states that the “royal apartments” are on a level with the surface of the ground; but, *in every case*, I have found them elevated from 1 to 2 feet, depending on the height of the structure. Indeed, at certain seasons, this elevation becomes a matter of necessity in many localities. Were it otherwise, the royal pair would be in danger of inundation during the long and violent rains of that country.

Immediately above the royal apartments, extending across and up the sides of the hill to about two-thirds their height, are the “nurseries” of Smeathman, a yellow, dry, comb-like granulated substance, inclosed in moist red clay, so moist that it can be made by the hands into balls. In this substance are numerous narrow serpentine cavities or cells, containing eggs and young in different stages. Scattered on the surface are perceived, in a recent state, many minute white globular fungi. Imme-

diately above, and interior to the nurseries, lie the "magazines" of Smeathman, rising to the height of about a foot. These are a cellular arrangement of soft clay, filled with a dark brown granulated substance, supposed by Mr. Smeathman to be the "food." It is very moist, and appears to be vegetable substance, comminuted and reduced to this state by the insect.

Between the royal apartments and nurseries is the first-floor of Smeathman; immediately above the magazines is the *second*; then comes the "dome," a large cavity in the upper part of the structure. With the dome there is a communication by numerous passages with the different parts of the hill, and thus a free circulation of warm air kept up, giving a uniform temperature to the domicile. The principles of philosophy known in the tendency of air to an equilibrium, its ascent when rarefied, condensation and descent in coming in contact with a colder medium, thus securing a uniformity of temperature, are all involved in this peculiarity of structure.

The statement of Dr. Smeathman respecting the primary size and subsequent mode of increase of the royal apartments is a matter of deduction, though undoubtedly correct. In small hills the queen is found of corresponding size. As the hills increase, the size of the queen and her apartments are known to increase. The adjacent portions must be taken down to meet this enlargement. This is true also of other portions of the structure. As the outer projections, or turrets, are sent up from within, and the intervening spaces filled out, a portion of what was previously the exterior must be removed, to admit of the expansion of the interior arrangements, the nurseries, magazines, &c. This change and removal must be more or less true, also, of almost all parts of the domicile.

The community was divided by Smeathman into three orders: 1st, the workers; 2nd, soldiers; 3rd, the perfect insects, male and female, or king and queen; a fourth order or state was subsequently noticed by Latreille among another species in the south of France, at Bordeaux (*Termes lucifugus*). It was afterwards observed in the East Indies, and incidentally noticed by an anonymous writer in manuscript on a Ceylonese species (Kirby and Spence's *Introduct.* vol. ii. p. 33). This was the nymph or pupa state of the *workers*, in which rudimental wings were observed. The same state was inferred and averred of *T. fatalis*, by Messrs. Kirby and Spence, and adopted by compilers. I have never known this inference to be confirmed by any observer writing on the African species; but I am happy in being able to assert the fact from personal observation, and, furthermore, to declare the *same of the soldiers*. I have seen both with rudimental wings distinct. Messrs. Kirby and Spence suppose the

pupæ to be equally active with their respective larvæ, which is not the case; they are exceedingly delicate and sluggish.

Of these several orders, the labourers are by far the most numerous. They seem to be susceptible of two divisions—*larger and smaller labourers*. The latter exceed the former in numbers, and are found chiefly in the domicile. The work about the hill, such as constructing, repairing, bearing away the eggs from the maternal department, &c., seems to be done by them. Of the larger size, some few are found in the hill, but they exist in greater numbers in the covered ways, about and in the objects of plunder. The mandibles of this division are very hard and strong, and admirably adapted to the performance of what I suppose to be their part in the community, which is the comminuting of the different kinds of wood on which they prey, and the reducing of the clay from which their hills are made to a portable condition. A like division of labour I have noticed among the Driver Ants of Africa (*Anomma arcens* and *A. rubella*). Messrs. Kirby and Spence are incorrect when they say (Introduction. vol. ii. pp. 40, 41) that “they carry in their mouths a mass of mortar half as big as their bodies, ready tempered, made of the finer parts of *gravel*, which, worked up to a proper consistence, hardens to a substance *resembling stone*, of which their nests are constructed.” The amount each insect carries at a time is so small as to be hardly perceptible to the naked eye. When the work is done it presents a minutely granulated appearance, like that of the “nurseries.” Nor is it already “*tempered*,” ready to be laid. The insect, when it arrives at the place of deposit, stops for an instant, and retaining its hold on the piece of clay, undergoes a slight tremulous movement, more perhaps like the spasmodic action of vomiting, when a *fluid being seen to be excreted from the mouth* over it, the clay is deposited. This corrects the supposition of Smeathman, that the cementing medium was gum obtained from the trees on which they preyed. The outer surface of the work when recent presents a red, moist, granulated appearance, but when acted on by the sun and atmosphere it approaches a dull white or yellow, and is highly indurated, more so than simple clay dried in the sun can be. It however falls far short of the hardness of stone; as the hill is penetrated, the clay becomes softer until the interior is found to be so plastic that it can be made into balls under the pressure of the hand. The young of this order are seen of all sizes; the *nymphæ* of Latrille differing from the others apparently in no respect but that of their rudimentary wings.

*Soldiers*.—Of this order there seems to be ground for two divisions also, *larger and smaller*.

When a breach is made in the hill, the smaller soldiers are

seen with the labourers in small numbers, and retreat with them to the interior. Then appear the larger soldiers, whose duty especially it is to defend the community. Their conduct, ferocious aspect, &c. have been well described by Smeathman, and need not be here repeated. It has been said, however, whether by Mr. Smeathman or not, I cannot state, that in the act of biting "they never quit their hold even though they are pulled limb from limb" (Kirby and Spence, *Introduct.* vol. ii. p. 40).

This assertion has been correctly made of the Driver Ants of Africa (*Anomma arcens* and *A. rubella*), but cannot be of the *Termes fatalis*. It is the habit of this insect to let go immediately after biting, and strike as fiercely at another place, doing this several times in quick succession. The manner in which its jaws operate will not admit of a continued hold. Like scissors (unlike the mandibles of the *Anomma*) they cross each other, separating the fibres by a clear cut through.

In about fifteen minutes after the attack of the enemy, the work of reparation begins by the labourers, who, accompanied by a few of the smaller soldiers, and occasionally a larger, appear in great numbers. In view of the duty performed by these two orders, it is a surprising fact that both males and females are without eyes.

These, at particular seasons, leave the hills in vast numbers. "The rains," as they are familiarly termed in Africa, begin in May, sooner or later, and continue with some intermissions until October. During the month of July, and sometimes extending into August, an intermission takes place under the name of "middle dries," dividing them into "early and latter rains." At the beginning of these seasons—"early and latter rains,"—the *Termes swarm* (if it may be so called) in incalculable numbers. At their exit so rapid is their ascent, that they present the appearance of smoke rising from all parts of the hill. The holes through which they escape are temporary, created for this purpose, and closed when the *swarming* ceases. During this process, the atmosphere for many rods distant seems to be filled with them. Birds are then seen whirling and darting through the air in quick pursuit—all orders of insect-eating animals are now on the alert. Barn-yard fowls are seen to jump up several feet from the ground to catch them as they descend. Indeed, men as well as brutes make them their prey. All tribes of Africans however do not eat them. The Grebos, who inhabit Cape Palmas, and among whom these observations were made, reject them as food. Why, it is difficult to tell, unless it be from the trouble attending their capture. It is not from any fastidiousness of taste, for they are known to eat snakes, toads, grubs, beetles, and even putrid meat, with zest. Tribes about fifty miles to the

windward of Cape Palmas use them as food. To catch them, bowls of water are set on the ground, into which they fall as their wings drop off. They are then roasted as shrimps, and the larger beetles (*Goliathi*) are said to be equally sweet.

The individuals of the two sexes appear to be about the same size when they issue from the hill, *not exceeding half an inch*. The largest queen I have ever seen at the head of a community measured  $4\frac{3}{4}$  inches in length.

Messrs. Kirby and Spence state that the queen lives but two years, which is incorrect. I have observed the yearly increase of hills for *five years* or more, and, when dissected, they have yielded a queen of corresponding size. To say that a successor to the original one might have been elected would be gratuitous. Nothing is known of their habits to warrant such an assertion, while everything we do know goes to prove that they live for many years.

It is stated also, that but one queen is ever found in a hill. This, too, is incorrect. But one is generally found. I have known two to occur. They were contained in the same structure, called by Smeathman "the royal chamber," but separated by a septum of clay. The hill was of the usual size. It was "dug down" by a colonist at Cape Palmas, who, knowing that I was investigating the habits of the insect, kindly brought them to my residence. I regretted exceedingly my inability to decide the question which arose to my mind at first sight, "Is it a case of bigamy?" The person who discovered them took no notice, and was unable to say that he saw even one king. It occurred to me that it might be an anomaly. I therefore made inquiries at Montserrado and the different European settlements that I visited, and ascertained that the same thing had occurred at those points, though it was considered quite unusual.

I am able here to confirm the truth of Mr. Smeathman's statement, that the king and queen are permanently inclosed in their apartment, which has been doubted by the eminent writer of the article *Termitidæ*, in the 'British Cyclopædia of Natural History' (understood to be J. O. Westwood, Esq.).

The sentence in which the doubt occurs runs as follows:—  
 "The young queen of the hive swarms is followed by a portion of the community; and the female after swarming, and the loss of her wings, is guarded by the worker ants; there is, therefore, so much analogy in these circumstances that we are almost tempted to consider that Smeathman must have erred in stating that the working Termites imprison both the king and queen Termites. That it should be necessary for the latter to be carefully guarded will be very evident; but why the king in his helpless and wingless state (for we consider that the loss of wings is

consequent upon and not precedent to pairing) should be shut up, seems questionable. We make these observations with hesitation, because Latreille, and Kirby and Spence seem to adopt, without hesitation, this statement of Smeathman."

I feel it my duty to notice particularly this doubt, coming as it does from a source of such high respectability as the present Corresponding Secretary of the London Ent. Soc., J. O. Westwood, Esq.

It should be remembered that in penning this doubt, Mr. Westwood was sitting within-doors at Hammersmith, England, many thousand miles distant from the scene of Mr. Smeathman's patient and prolonged observation. Mr. Smeathman states what he *knew to be a fact*, and respecting which I can see no way in which he could be mistaken. Mr. Westwood misapprehends a remark of Mr. Smeathman on their "swarming," if it can be so called. I do not understand Mr. Smeathman to state that the queen is accompanied by any other individuals than those of the two sexes—other perfect *males and females*. He says that as *workers* are always to be found on the *surface of the ground*, the king and queen are *captured by them*, and thus made to become the heads of new communities. On what foundation *this* statement rests I know not; but must confess that in this part of their œconomy I think there exists a lacuna yet to be filled. As to the statement, however, involving the perpetual imprisonment of the king and queen, I have no doubt. The facts respecting the structure of the "royal chamber" sufficiently prove it. Any one who has seen a fully-developed queen will say that she is incapable of progression, and the fact that no aperture has been discovered in the "chamber" among the many hills dissected at different seasons, sufficient to admit of the ingress and egress of the king, and hardly of the larger class of soldiers, must suffice.

It has been stated also by compilers of Smeathman, that the insect shrinks from light, which is a reason for their constructing covered ways. But if it be remembered that the two orders—soldiers and workers—are perfectly blind, the assertion must appear to be gratuitous. The true cause of their erection of covered ways would seem to lie in the fact that the insect is a prey to a vast number of other insects, reptiles, &c.

Smeathman and others state that *Termes bellicosus* is the insect which devours dwelling-houses, furniture, &c. This also I consider an error. I doubted its accuracy at the commencement of my observations, and made inquiries subsequently of intelligent observers at Sierra Leone and Montserrado, all of whom confirmed me in my doubts. The white ants found in our houses preying on our furniture, books, &c. are *smaller*, and larger in proportion to their breadth, than *T. bellicosus*. The soldiers which accom-



pany the labourers and are found with them in their covered ways along the sills, floors and roofs of our houses, differ palpably in these respects from those of *T. bellicosus*. I made known my doubts on this point to my correspondent Mr. Westwood of London, proving the truth of my statement by specimens taken from my own dwellings, but, unfortunately, the bottles containing them were broken, and I failed of my object. I consider these *house-eaters* as the *T. arborum* of Smeathman. One of their nests, indeed, I found in the roof of my office, and by them great damage was done to the building; besides many books were destroyed, having been eaten through and through. Another nest also was found in a small out-building; the insects of these two nests corresponded to those found in my dwellings, &c., while marked differences existed between the latter and *T. bellicosus*. I regret exceedingly that the steps to prove this opinion have failed in the manner above stated. I hesitate not, however, to assert it, confirmed as it is by other observers.

#### *Hills dissected.*

*Hill 1st.*—Opened 22nd March, 1842. General outlines very much like those of a hay-stack; situated in a valley.

#### *Measurement.*

Circumference at base . . . . .	34 ft.
" at $\frac{2}{3}$ height from base . . . . .	25 "
Height from apex to base on the surface . . . . .	13 "
" " " perpendicular . . . . .	9 "

The work was begun with three men at 20 minutes past 4 P.M., and required  $2\frac{1}{2}$  hours to accomplish it.

The material was red clay, obtained about two feet below the surface-soil, the latter being a mixture of sand and decayed vegetable matter brought down from the surrounding hills. The surface was highly indurated, receiving a slight impression from a single blow of the mattock.

The order first seen was the workers, who instantly retreated on exposure to the external air. They were succeeded by one and then another, and then many of the larger class of soldiers, who, rushing out in great rage with jaws extended, threatened vengeance on the intruders.

The experiment of permitting them to bite was tried several times, when it was perceived that a drop of brownish fluid was exuded upon the part. The sensation was like that of a minute sharp-cutting instrument, the jaws moving in cross direction like scissors.

On breaking several of the upward projections or "turrets," they were perceived to be hollow, leading into the "dome," and

the main passages in the walls down to the basement. These several passages were smooth, as if by being well-worn by constant tread, and it undoubtedly is through them that their food is brought from below to the "magazines." The first fragment of the hill exposed numerous apparent perforations, from the size of a shot to that of a dollar, which were increased by every stroke; these were the different passages, running in every direction and anastomosing with each other, keeping up a communication throughout the domicile.

The walls seemed to be about 12 inches thick, and contained numerous cavities or cells of various sizes and shapes, with young in different stages of growth, extremely white and delicate. They communicated with each other and with the main passages. The number of young contained in them varied from twelve to twenty. When several were found in one cell, they were regularly and closely packed, with their heads converging towards the bottom. The first idea which this arrangement presented to my mind, was that of pigs in an autumnal night, stowed in the angle of a "Virginia fence."

Having beaten away the wall of the hill, a layer of light brown spongy substance was seen, its structure irregularly cellular and inclosed in red moist clay of corresponding form; the "nurseries" of Smeathman. The cells contained young of different sizes; on the surface were visible numerous scattered minute white globular bodies, probably fungi. Messrs. Kirby and Spence suppose them to belong to the genus *Mucor*. But the *Mucorini* are generated from decayed animal and stercoraceous matter. Without a microscopic examination, they seem to me to be assigned more naturally to the *Trichocisti*, perhaps *Trichia*, the *pin-head fungi*, which are known to spring from decayed vegetable substance. It is highly probable that the material of which these nurseries are made is at base vegetable matter. Their extent, as thus observed, is from the base to two-thirds the height of the sides of the hill. Centrally to these, and lying immediately under the floor of the "dome," was a series of cellular work, entirely of clay, filled with a chestnut-brown substance, very moist, having the appearance of rasped or gnawed wood, and other vegetable matter. These are Smeathman's "magazines" and "food," which, with the nurseries, constitute almost two-thirds of the contents of the structure.

Throughout the nurseries were found young in different stages of growth: those in the external cells were smaller and mostly without rudimental wings; those in the interior cells were larger, with distinctly developed mandibles and rudimentary wings generally, the *pupæ* of *soldiers*. The young in the interior of this cellular work, with a few exceptions, were assuming the yellow

colour which marks the head and thorax of the workers and soldiers in their perfect or active state ; the exceptions were of a pure white.

As the larger passages were opened, a strong current of warm air from within was perceptible. I attempted to look down the "dome," but was compelled to withdraw immediately, my respiration being affected, and the glasses of my spectacles coated with a film of moisture ; a strong, peculiar, but not unpleasant odour was perceived. It was observed, that the deeper we penetrated, the more numerous became the young, and the more advanced were they in growth.

The structure called the "royal chamber" by Smeathman was discovered in a position central in respect to the circumference of the hill, and about 18 inches above the surface of the ground. Around and beneath it was a connected series of clayey cellular work, in which were found the young, as before stated. The *chamber* was of an oblong shape, rounded at the ends and sides ; flattened and thick above and below. It was supported on one side by two pillars about three-quarters of an inch in diameter ; on the other, it was attached to the surrounding clay-work. I accidentally broke open the inclosure, being misled by the statement of Smeathman, that it was situated on a level with the surface of the ground. The queen was discovered, surrounded by a large number of the larger labourers, a few soldiers, and some of the more advanced pupæ, all of whom were running rapidly round her, manifesting the greatest perturbation. The queen made great efforts at progression, constantly turning her head and thorax from side to side, but without moving in the least her huge abdomen. Her whole length was  $4\frac{1}{2}$  inches. The king, evidently in great alarm, made repeated efforts to conceal himself under the abdominal folds of his consort.

On examining further the "royal chamber," a wide cavity was observed running horizontally along the upper part or roof, externally, but without any signs of communication with the interior. On the under surface of the roof, or ceiling, is a long depression, corresponding in shape to the body of the queen, which gives her that freedom of motion necessary to the extension of her eggs. This motion is compound, first in a longitudinal, then transverse direction, alternately elongating, contracting and widening her body, which is marked with short, thick, transverse bands. The skin is thrown into folds, while these bands operate as so many fixed points or centres of muscular action, forcing the eggs through their ducts to the place of exit.

For some time after exposure, the queen continued the expulsion of her eggs, but not, as I am inclined to think, to the usual extent. They were white and very minute, and left untouched

by the workers, who evidently continued in a state of the greatest alarm.

The floor of the chamber was perfectly plane and smooth, exhibiting not the slightest impression from the body of the queen. The roof in the centre was  $\frac{3}{4}$  of an inch thick; the floor about  $\frac{5}{8}$ ; at the line of conjunction about  $\frac{1}{2}$ . Posteriorly in the line of junction between the roof and floor was a small aperture, sheltered from above by a spur of clay running downwards, which was the only way discovered of ingress and egress. It could not have admitted an insect larger than the soldiers, and even to them, as it then appeared, it must have been a "strait gate." The king could not have passed, and, consequently, not the queen. It had the appearance of having been repeatedly closed and opened by collections of clay around it.

That the queen is inclosed for life, is evident from the fact that she is, from her great size, incapable of progression of herself, or of being transported by any means within the power of the community.

On clearing away the refuse at the base of the hill, the orifices of the main passages under the basement were discovered; descending in a sloping direction, they led to large vacant rooms, made by the pillars supporting the archwork, on which rests the interior of the structure. These pillars or columns were of an irregular, rounded shape, from  $\frac{1}{2}$  to  $2\frac{1}{2}$  inches in diameter, and stood on the solid ground about 6 inches high.

On visiting this hill the next morning, all the passages in that portion of the wall not dissected were found well closed with fresh deposits of clay, and also a continuous layer spread over the remaining central cellular work. This was done during the night by the surviving members of the community for their protection against the cool air of the night, the rain, and hostile insects.

The opening of a hill is the signal for the gathering of all their foes,—ants, reptiles, &c.; hence the speedy closing of their various entrances is a step of primary importance.

Another hill, previously dissected, was, after a time, so far repaired as to be externally perfect. On taking it down again, though the cellular work was apparently restored, no queen was found nor royal apartments; a few workers were all the insects discovered, and they were collected in the cells in the walls of the hill.

*Hill 2nd.*—Opened Feb. 3rd, 1847.

Circumference at base . . . . . 26 ft. 10 in.

Height on the outer surface . . . . . 8 „ 6 „

A diagonal section was made by a cross cut saw, beginning just below the upper floor of Smeathman.

The walls were much the thickest on the north side, nearly double those on the south, measuring  $1\frac{1}{2}$  foot through.

It being in a locality where sand and gravel abounded, their materials were freely mixed with the clay.

The covered ways leading from the base to objects of plunder at a distance were in this case larger and more numerous than any I have seen before. The main one measured 12 inches in diameter, and gave off several branches which proceeded in various directions. These were traced to sticks, stumps and logs, which afforded them prey.

In this case the labourers in the hill were generally of the smaller class, while those in the covered ways and in the stumps were larger, having strong, stout jaws, well-adapted to the gnawing of wood. The "royal chamber" was found raised about  $1\frac{1}{2}$  foot above the level of the ground.

*Hill 3rd.*—Circumference at base, 50 feet. Height, 14 feet.

The notes do not state whether this is the perpendicular height or not. Several fresh turrets were erected on the top, having a moist, deep red, granular appearance.

The structure called the "royal chamber" measured externally 10 inches in length, internally 8 inches. Its height from the level of the ground was 2 feet 8 inches. The length of the queen  $4\frac{3}{4}$  inches.

Shrubs or small trees are frequently seen growing up through the hills. Such trees are never seen dead, consequently are not eaten by the insect.

## XI.—On a supposed new species of *Glyceria*.

By FREDERICK TOWNSEND, B.A.\*

IN 1846 I drew up a description of a supposed new species of *Glyceria*, which had probably been confounded with other described species, viz. *G. fluitans* and *G. plicata*; and a paper on the three plants was read before the Botanical Society of Edinburgh on November 9 in that year, but for the purpose of adding the results of further observations, it was not then published. Revised characters for, and some remarks upon, the three supposed species are now again submitted to the Society.

In my former paper I applied the name of *G. hybrida* to the new plant; but as the use of that word might lead to erroneous theoretical conclusions, I now substitute the name of *G. pedicellata*. The specific characters may stand as follows:—

1. *Glyceria fluitans* (R. Br.). Panicle simple, elongate, subsecund, spreading whilst in flower, otherwise close; branches

\* Read before the Botanical Society of Edinburgh Dec. 13, 1849.